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IMPROVEMENT IN THE COMMERCIAL SUPPLY OF SPICES AND CAUSE OF SAME.

By L. E. SAYRE.

IT is instructive to note that the commercial supply of spices has improved to a marked degree since the enactment of the food and drugs law. At one time the common spices, such as cloves, pepper, cinnamon, allspice and ginger, were so freely adulterated that the public became accustomed to the use of large quantities of spices for flavoring. Recently the chef not aware of recent improvements in quality has been somewhat surprised that such small quantities of these aromatics are required to produce the desired effect.

Recently, commercial samples of spices were collected from different grocery stores and examined in order to study the question of market supply—whether an improvement existed. First, two recognized spices were collected—cloves and allspice. Examination was made, under supervision, by Mr. John F. King, a senior student. The data obtained from these were:

1. Moisture.
2. Ash.
3. Volatile ether extract.
4. Nonvolatile ether extract.
5. Crude fiber.

This was considered sufficient for the purpose of this investigation.

It may be remarked that adulteration always implies added foreign substances. Cloves, for example, sometimes contain a large percentage of stocks upon which the clove buds are borne. These are imported in considerable quantities. They yield about 5 or 6 per cent of volatile oil, while the genuine cloves should contain from 15 to 20 per cent. Another product of the clove plant is the nearly ripe fruits, which are designated as mother cloves. They are dark brown, ovoid, one-seeded berries, crowned by the remains of the calyx teeth. They contain but little volatile oil. Both clove stocks and mother cloves have been used to adulterate ground cloves.

Clove stocks may be detected by the presence of numerous characteristics, nearly isodiametric, sclerenchymatous cells—

the latter by the large starch grains which the seeds contain. Blown cloves, also an adulterant, are those which have been collected after the petals have expanded. Both the petals and stamens have been broken off, leaving the thick portion of the clove crowned by somewhat prominent calyx teeth.

It is evident from the above that the microscopist has a ready means for detecting these spurious admixtures, and coupled with the chemical analysis furnishes data which is legally satisfactory.

In connection with the chemical examination, we note, from the results of a prominent food inspector, R. O. Brooks, the following maximum and minimum limits of constituents, found in eighty-six analyses of botanically pure cloves:

	Minimum. Per cent.	Maximum. Per cent.
Moisture	2.90	11.80
Volatile ether extract (oil).....	11.03	20.53
Nonvolatile ether extract.....	4.87	12.00
Quercitannic acid	11.28	24.18
"Protein" ($N \times 6.25$)	4.20	7.06
"Starch" (by diastase method).....	2.08	3.15
Crude fiber	6.18	9.75
Ash (mineral matter).....	5.03	13.05
Ash, insoluble in acid (sand).....	0.00	0.13

This author, speaking of clove stems as a common form of adulteration, says the federal standard provides for a reasonable and unavoidable presence of clove stems, viz., 5 per cent. The skilled spice microscopist can tell very closely whether this limit has been over-stepped, although it is doubtful if strictly chemical means would prove it, unless the adulterant is present in large amounts. The most noticeable difference, chemically, which would upset the chemical values of pure cloves, if a considerable admixture were attempted, is the decidedly greater portion of fiber found in the stems. The following he gives as the mean results of two analyses of clove stems:

	Per cent.
Moisture	8.74
Volatile ether extract.....	5.00
Nonvolatile ether extract.....	3.83
Quercitannic acid	18.79
"Protein" ($N \times 6.25$)	5.88
"Starch" (by diastase method).....	2.17
Crude fiber	18.71
Ash (mineral matter).....	7.99
Ash, insoluble in acid (sand).....	0.60

In order to adulterate a clove with clove stems, the clove must be very rich in oil, because of the low volatile ether ex-

tract which clove stems yield, which would preclude them as favorable adulterants.

Other adulterants which have been reported as having been occasionally found in ground cloves are allspice, exhausted ginger, cereal products, ground nut-shells, olive stones and charcoal. It is needless to say that microscopical analysis readily shows any such sophistication.

Analysis of a recently secured sample of pure cloves gave the following results:

Moisture	1.84%
Ash	5.80%
Volatile ether extract	12.49%
Nonvolatile ether extract	8.21%
Crude fiber	8.64%

Tabulated below will be found the results of analysis of four samples, which fairly exemplify the average condition of the present market. These samples were selected out of a number of others as representative for the investigation. It will be noticed that no estimation was made of the tannic acid, which is always present in the form of gallotanic, or quercitannic, acid in cloves. This constituent is usually present to the extent of about 13 per cent. The most essential constituent, of course, is the volatile oil contained in the ether extracts.

Sample.	Moisture.	Ash.	Total ether extract.	Volatile ether extract.	Nonvolatile ether extract.	Crude fiber.
No. 1	1.52	8.43	16.39	9.44	6.95	10.03
No. 2	2.43	7.91	18.06	11.10	6.96	9.38
No. 3	2.05	6.54	21.04	12.97	8.04	8.10
No. 4	2.69	6.58	19.72	11.41	8.31	8.97

Microscopical examination showed the powder to be the product of the clove fruit without foreign admixture of extraneous substances.

ALLSPICE.

This condiment is composed of the full-grown *but unripe* fruit of the "Jamaica Pepper" plant. The berries are gathered before they are fully ripe, as the aroma is partly lost if the fruit is permitted to mature completely. On drying the berries become almost black. Sometimes they have been made more attractive by coloring them with a brown ochre, a sophistication of which may readily be detected.

Allspice, like mother cloves, contains starch, which under the microscope appears as nearly circular granules with a central spot or hilum, and often arranged in groups as are

buckwheat starch granules. There are other starchlike or gummy substances in the fruit which by acid inversion yield a considerable amount of reducing material.

R. O. Brooks' analysis of twenty-five samples of pure allspice has yielded the following maximum and minimum percentages of proximate constituents:

	Minimum.	Maximum.
Moisture	5.51%	10.14%
Ash (mineral matter)	4.01	7.51
Ash insoluble in acid	0.00	0.95
Volatile ether extract (oil)	1.29	5.21
Nonvolatile ether extract	1.60	7.72
Starch by diastase method	1.82	3.76
"Starch" by acid inversion	16.56	20.65
Crude fiber	13.45	23.98
Protein (nitrogen $\times$ 6.25)	4.03	6.37
Quercitannic acid	4.32	12.48

Our analysis of commercial allspice as collected promiscuously on the market is represented fairly well by the following selected analyses from a number of samples:

Sample.	Moisture.	Ash.	Total ether extract.	Volatile ether extract.	Nonvolatile ether extract.	Crude fiber.
No. 1	1.43%	3.17%	9.56%		5.09%	13.39%
No. 2	4.19	4.76	8.22	2.38%	5.84	17.45
No. 3	1.17	5.29	8.49	3.11	5.38	14.51
No. 4	3.12	5.53	9.21	3.35	5.86	14.10
No. 5	3.17	4.36	8.77	5.61		15.03

These results, both microscopically and chemically, show that since the enactment of the pure food and drugs law few samples of these spices on the market are adulterated. However, before the enactment of the law, the majority of spices were found to contain much foreign material.

It should be added, in this connection, that the same statements hold true with regard to black pepper. At the time of the enactment of the food and drugs law it was stated it was a question whether ten per cent of the spices that were on the market previous to the passage of the law were unadulterated, the adulteration sometimes running as high as 92 per cent of ground olive pits. The examination of the samples of the market of recent date show that the actual percentage of low-grade pepper amounts to less than ten per cent. This is a good showing for the administration of the food and drugs law.